



EVALUATION AND REDUCTION OF CARBON EMISSION TO MAKE EDUCATIONAL INSTITUTION CAMPUS CARBON NEUTRAL

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ABSTRACT

Climate change is one of the most serious challenges the world is facing. Addressing this challenge is a shared responsibility of all governments, businesses and the wider community. All across the world, colleges and universities are looking to become carbon neutral. Universities are taking responsibility for their environmental impact and are working to neutralize those effects. To become carbon neutral, universities are working to reduce their emissions of greenhouse gases, cut their use of energy, use more renewable energy, and emphasize the importance of sustainable energy sources. Universities that have committed to becoming carbon neutral have recognized the threat of global warming and are therefore committing to reverse the trend. Following are the 4 tasks that need to be accomplished: (1) Creating an inventory of Green House Gas (GHG) emissions; (2) Coming up with detailed solutions to achieve Carbon Neutrality; (3) Working out a practical schedule to implement those solutions and (4) Developing a realistic plan to finance the process of achieving Carbon Neutrality. This paper discuss ways minimize the carbon emission at Dr. D. Y. Patil Institute of Technology (DIT) campus located at Sant Tukaram Nagar, Pimpri Pune. For the same existing pattern, will be studied and suitable suggestion will be given based techno-economical feasibility.

KEYWORDS: Institution; Carbon emission; Greenhouse gases; Sustainable energy; Carbon neutrality.

INTRODUCTION:

Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forcing, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.

Climate change has many different aspects to it. One can associate climate change with rise in sea water levels, change in atmospheric temperature, changing ecosystems, melting polar ice, and so on. It may be due to either natural or human influences. Scientists from all over the world have been working to find out the cause and impacts of climate change, for more than a century but there are still gaps in our knowledge. However, most of the experts feel that human activities are having an adverse effect on our planet. Anthropogenic activities related to consumption of fossil fuels are mainly responsible for the GHG emissions. These emissions in the atmosphere are attributed to create a greenhouse effect subsequently leading to global warming.

Need of Carbon Neutrality:

Carbon neutrality is defined as the term that recognizes all of the actions of a per-

son, project or an institution that result in zero net carbon dioxide emissions. It can be achieved by increasing energy efficiency and improving energy conservation, as well as by using renewable energy. Climate change is one of the most serious challenges the world is facing. Addressing this challenge is a shared responsibility of all governments, businesses and the wider community. All across the world, colleges and universities are looking to a sustainable future by working to become carbon neutral. Universities are taking responsibility for their environmental impact and are working to neutralize those effects. To become carbon neutral, universities are working to reduce their emissions of greenhouse gases, cut their use of energy, use more renewable energy, and emphasize the importance of sustainable energy sources. Universities that have committed to becoming carbon neutral have recognized the threat of global warming and are therefore committing to reverse the trend.

According to a report CO₂ emissions India is increased by 4.4% in 2013, compared to 2012. The increase in CO₂ emissions largely reflects the increase in fossil energy consumption, driven mainly by emerging economies with a steadily increasing energy use over the past decade. And we are top 4 among the global emitters.

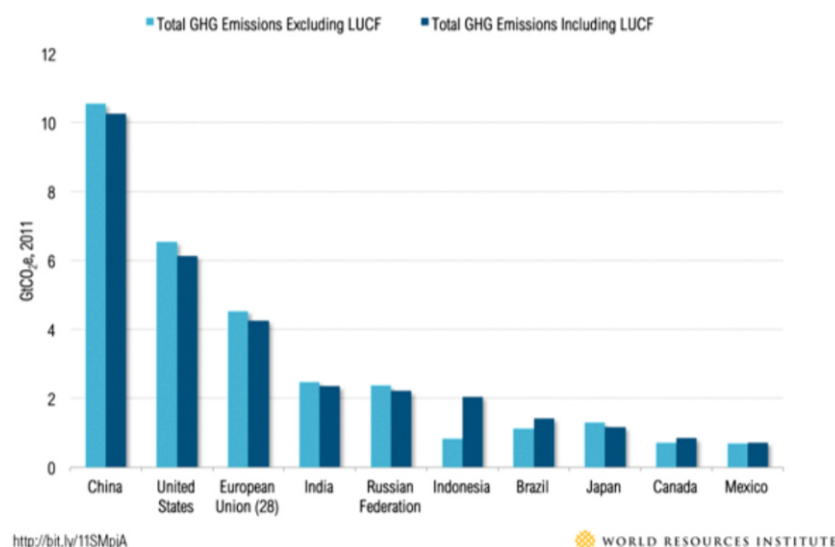


Figure 1: Top ten CO₂ Emitters
(<http://www.wri.org>)

Sources of Carbon emission:

Carbon dioxide (CO₂) is the primary greenhouse gas emitted through human activities. In 2013, CO₂ accounted for about 82% of all U.S. greenhouse gas emissions from human activities. Carbon dioxide is naturally present in the atmosphere as part of the Earth's carbon cycle (the natural circulation of carbon among the atmosphere, oceans, soil, plants, and animals). Human activities are altering the carbon cycle-both by adding more CO₂ to the atmosphere and by influencing the ability of natural sinks, like forests, to remove CO₂ from the atmosphere. While CO₂ emissions come from a variety of natural sources, human-related emissions are responsible for the increase that has occurred in the atmosphere since the industrial revolution.

The Introduction presents the purpose of the studies and relationship to previous work in the field. It is not required to incorporate an extensive review of the literature. Use only recent references and provide the most salient information to allow the readers to understand and evaluate the purpose and results of the present study.

LITERATURE REVIEW:

Warners and Heun (2007) has worked on the carbon neutrality project on Calvin college Michigan they have created an inventory of Green House Gas (GHG) emissions and sequestration potential. They came up with detailed solution to achieve carbon neutrality. As an approach to project they have divided students in five groups and investigated the following areas:

- Energy Use and Purchasing
- Land Use and Waste Water Management
- Recycling and Solid Waste Management
- Construction and Renovation

Transportation:

They have identified that the carbon foot print due to energy use on campus is a significant part of the overall carbon emitted by Calvin. Carbon emission are incurred by Calvin College due to energy use through two ways, natural gas combustion used for heating campus, and production methods used to create the electricity Calvin uses.

Aroonsrimorakot and Yuwaree (2013) has studied the Carbon Footprint of Faculty of Environment and Resource Studies, Mahidol University, Salaya Campus, Thailand. This study focuses on the importance of measuring the amount of greenhouse gases or Carbon Footprint by calculating greenhouse gas emissions in units of carbon dioxide equivalent (CO₂e) from the activities of the Faculty of Environment and Resource Studies, Mahidol University with data collection of greenhouse gases sources such as electricity and water supply consumption, quantity of wastewater and garbage, and amount of fuels used etc. Then, multiply these data by the emission factors that are recognized internationally. The results showed that a GHGs emission from Faculty of Environment and Resource Studies is equal to 1,091.85 tonCO₂e. Sources that emit the most greenhouse gases are the use of electric energy, followed by produced solid waste. Thus, power consumption and the amount of waste created should be reduced with the use of current energy-saving technologies or energy saving campaigns to reduce the power consumption of students and staff including waste classification to facilitate recycling and so on.

Sergio Pinheiro (2013) has an assessment of the potential for a carbon neutral UCD campus; Dublin this project is focused on the potential for University College Dublin (UCD) to become carbon neutral. Carbon neutral is the concept of cancelling out the emissions by reducing it to zero or preventing an equal amount of being released into the atmosphere. In additional, four alternatives were suggested to balance/offset the emissions. The results of this project show that UCD can achieve carbon neutral status by applying the alternatives suggested.

Kevin P. Crosby has done an environmental sustainable assessment report on Taylor college campus, Indiana. The assessment is divided into main sections of operations, administration, people, and finance. Most of the emphasis is on operations which includes nine main categories: carbon emissions, energy, transportation, water, waste, dining Services, built Environment, landscaping, and purchasing. The goals of this project are to provide data for benchmarking and to reduce the carbon footprints and sustainable development.

METHODS:**Pre-Audit Data Collection:**

- Vehicular Emission.
- Equipment and mechanical system specifications and their functions.
- Utilities information (electric/gas/water)
- Users and occupants information.
- Pre-visit to each building.

RESULTS:**Vehicular Emission:**

Vehicular Emission is considered for parking in the campus of DIT. The Emis-

sion is calculated in terms CO₂Equivalent

For Parking :DIT

No. of Bikes = 136; No of Cars = 182

CO₂Equivalent factor for Cars and Bikes is considered as 0.135 and 0.094 respectively.

The Travelling Distance for Parking 1 is considered as 0.7 km for 1 trip.

For Cars:

$$0.135 \times 0.7 \times 182 = 17.20 \text{ Kg CO}_2\text{e./day}$$

For Bikes:

$$0.094 \times 0.7 \times 1364 = 128.89 \text{ Kg CO}_2\text{e./day}$$

$$\text{Total} = 146.09 \text{ kg CO}_2\text{e./day}$$

In the same manner the emissions for Management and Pharmacy are calculated that are 49.82 and 134.

Emissions Calculation:

CO₂e. = Equivalent Factor x Distance (km) x No. of Vehicles

Therefore total Vehicular Emission in DIT campus is 329 Kg CO₂e./day.

Emissions from electricity:

Estimation of carbon emission from electricity is done on the basis of the consumption of electricity per Kilowatt.

The Average Electricity consumed by campus is 1433369.5 KW/month.

$$\begin{aligned} \text{Emission} &= \text{Use (KW/mnth)} \times \text{Eq. Factor for Electricity} = 1433369.55 \times 0.7 \\ &= 1003358.685 \text{ Kg CO}_2\text{e./month.} \end{aligned}$$

The Emissions from electricity are reduced only by the use of solar panel and awareness of campus population towards conservation of energy.

Reduction techniques of Vehicular Emission:

- Cleaner Vehicles- regulating emission standards for new vehicles/engine.
- Cleaner fuels: regulating fuel composition to reduce emissions
- Vehicle inspection programs: mandatory vehicle emissions testing such as PUC
- Consumer education: on items like idling, vehicle operation and maintenance programs to encourage cleaner, alternative transportation: such as carpooling, public transit, walking and biking.

CONCLUSION:

There is a need to recognize the sources that are directly and indirectly emitting carbon dioxide and equivalent gases. DIT campus needs to take action to reduce the impacts of transportation, waste, water and other emissions with the use of various techniques.

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